



Retrospect: we've come a long way

Editor's Note: *The list continues—Avondale, Monongah, Centralia, Farmington, and now, the dual disaster at Kentucky's Scotia mines. The following report is written from a historic perspective. It shows how we have made enormous progress in the cause of mine safety, but more important, it should serve as a reminder of the dangers still in underground coal mining. Our most recent "reminder," the explosions which snuffed 26 lives at Scotia Coal Company in early March of this year, will be explored in a future issue of MESA Magazine.*

The history of coal mining progress in this country is also a history of death and destruction. Since miners first moved underground, disaster and the pursuit of mining safety have too often gone hand-in-hand.

When coal was first discovered and mined, it was extracted along outcrops. As coal deposits became depleted near the surface, underground mining developed. When the first mine penetrated the outcrop, a great number of problems arose for the early miner, many of which remain today. One of those problems was the potential for mine gas and dust ignitions and explosions.

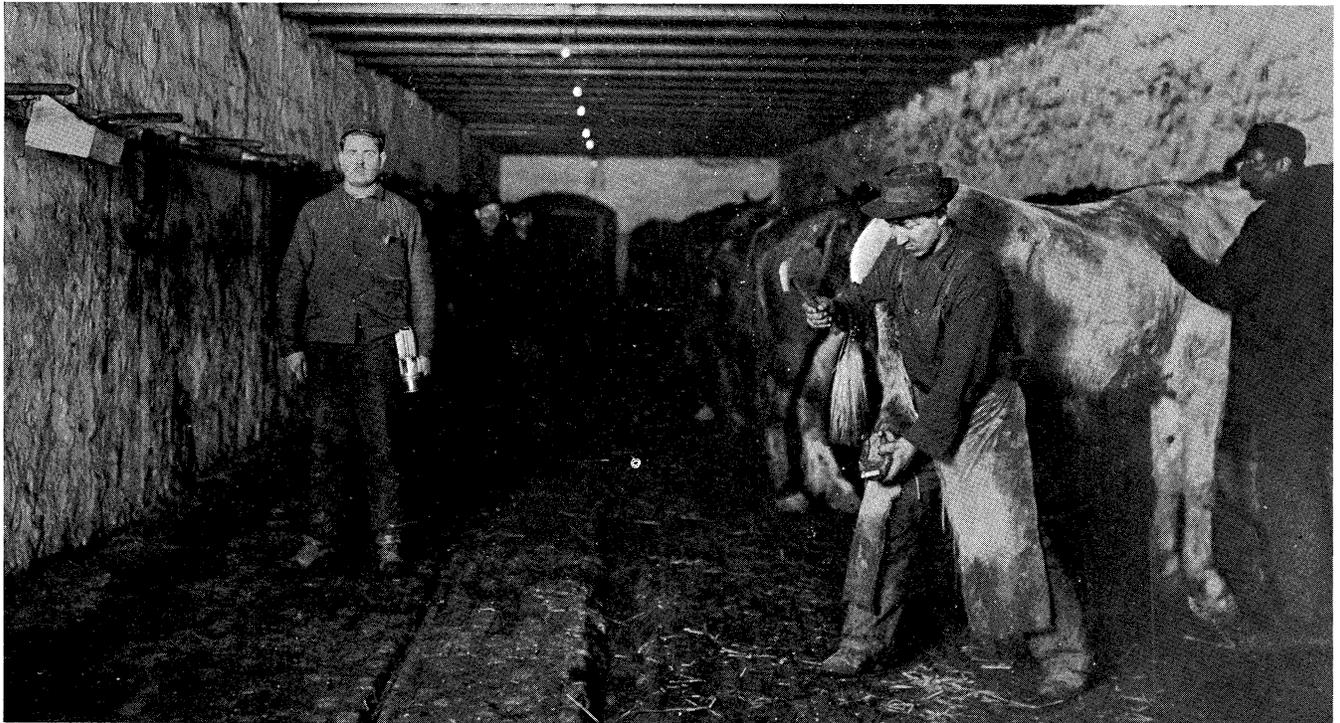
Naturally, when underground mining progressed several feet into the outcrop, some type of artificial light was needed. Early accounts of mining in Spain, Italy, Japan and Great Britain indicate that torches served to light the mines. Later, candles were used, and still later, earthen oil lamps fueled by fish



The back-breaking job of mining without mechanization.

oil were used. As workings were burrowed deeper, explosions began to occur which were thought to be caused by goblins or the devil.

As explosions became more frequent, it became obvious that the use of open flames for lighting was extremely dangerous. A substitute was sought. Dried fish skins which gave off a weak phosphorescent light were tried. A mixture of flour and lime made



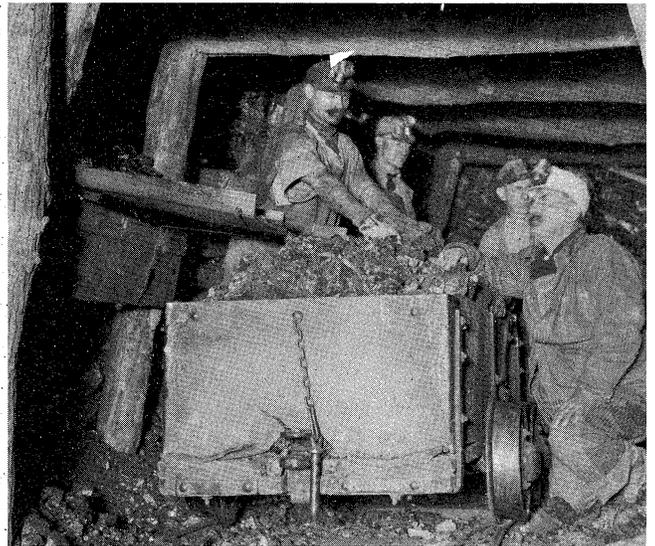
Horses and mules sometimes were born, stabled, worked and died underground, without ever seeing the light of day.

from oyster shells called Canton phosphorous was also tried unsuccessfully. At some mines, fireflies in a bottle were used.

In 1784, at the Wallsend Colliery in England, two explosions occurred. An account of those explosions mention the first attempts to use reflected sunlight for underground illumination. This method of lighting proved impossible because of obstructions and dust.

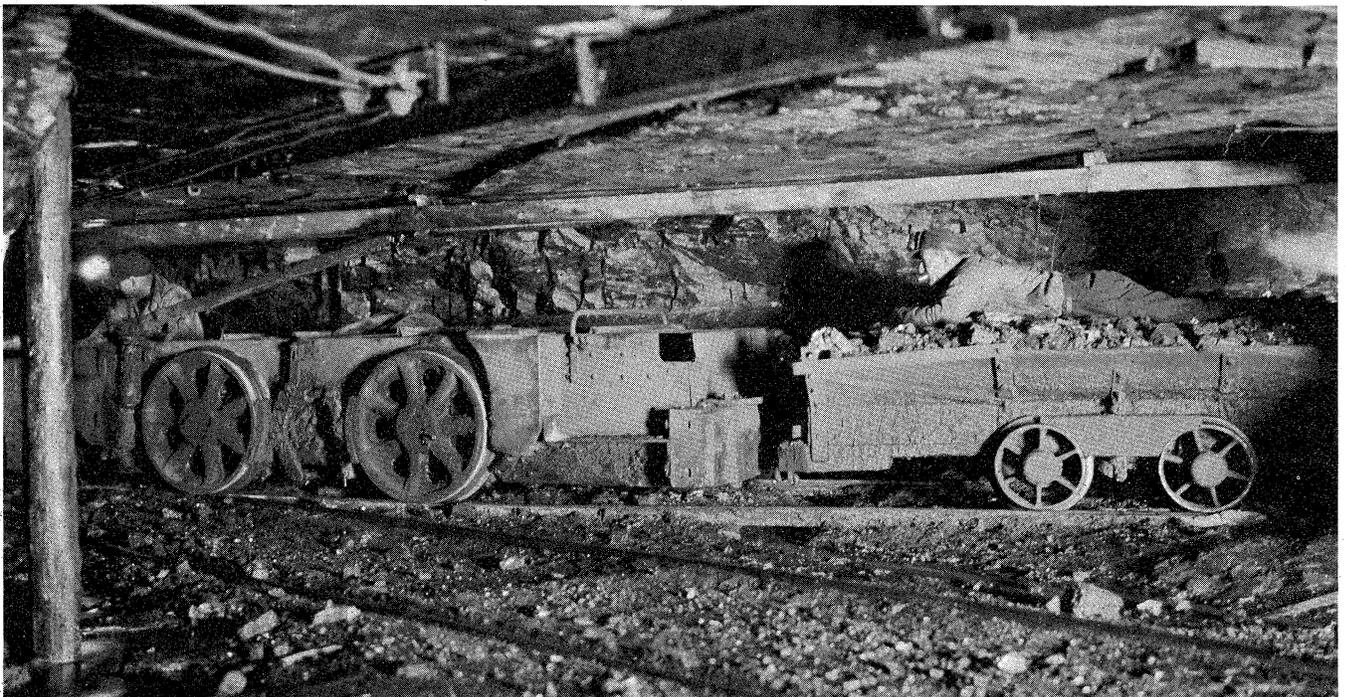
In a U.S. coal mining journal appearing in 1876, the author commented, as follows, on the means of finding gas accumulations before development of the flame safety lamp.

Before the discovery of the safety lamp the presence of firedamp in coal mines was ascertained by the miner creeping cautiously forward along the mine, holding a lamp or candle in one hand and screening the flame with the two forefingers of the other, meantime keeping his eye intently fixed on the top of the light. As he reaches the explosive compound, the top of the flame begins to elongate and to assume a color of greyish blue. He stops at this juncture, and slowly raises his light towards the roof where the firedamp floats. The flame now elongates into a sharp spire, the top changing from greyish blue to a pure blue, and giving off



Safety standards have changed a lot since this 1920's crew posed, with the man at left puffing a pipe.

minute luminous sparks. This is the extreme point of danger—a sudden movement of the body or a quick lowering of the lamp would cause an explosion. The miner lowers the lamp with great caution, and extinguishes the flame with his thumb and finger. This experience, termed 'trying the candle,' was one of extreme peril, and was entrusted only to the more coolheaded of the miners. If the gas was not very copious,



It's strictly against the rules now, but the man riding this underground haulage equipment back in the soft-hat days would do even more than walk a mile for a Camel—he risked his life and the lives of others by smoking a cigarette underground.

it was fired by means of 'the firing line.' A light was attached to the end of a cord that passed over a wheel at the wall face; the light was then drawn into the firedamp while the miner retreated to a safe distance. Sometimes the miner would wrap himself in a wet jacket, and stretching himself flat on the floor would raise his light and explode the gas over his head. In France, this person was sometimes called the penitent, as his head was covered by a mask resembling a monk's cowl, but he was more generally named the cannoneer of the mine.

Mine safety legislation made its debut in Great Britain. The disaster experience in the United Kingdom and its resultant legislation is also the heritage of the United States.

U. S. MINING BEGUN

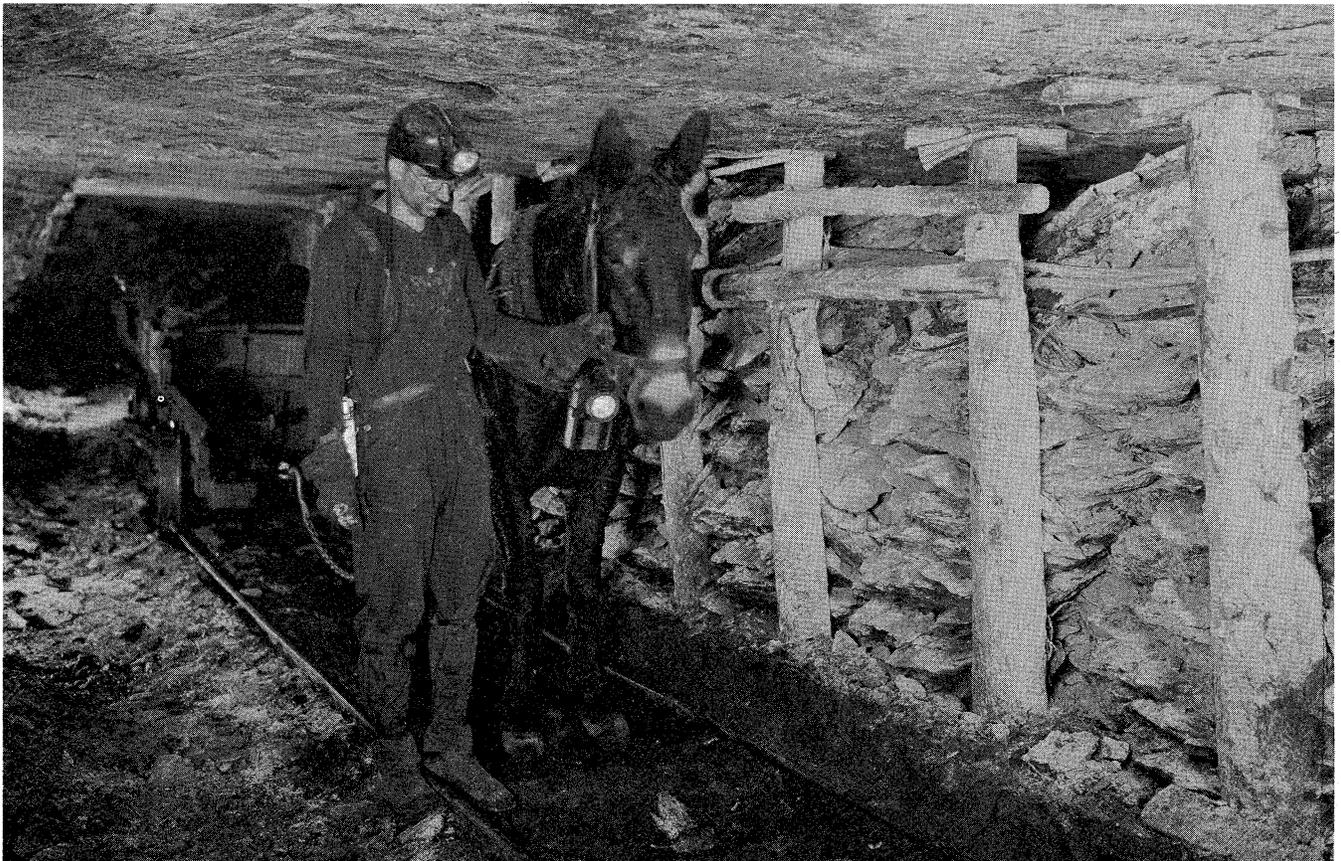
The first record of underground mining in the United States indicates that coal mining first took place near Richmond, Virginia around 1702. By about 1810, three of the numerous shafts then being worked were 300 feet deep. In these mines methane was

often liberated to form explosive mixtures in poorly ventilated workings. The first report of an explosion—found in a letter of 1818 describing the mines in the Richmond area, then known as "Heath's pits"—noted:

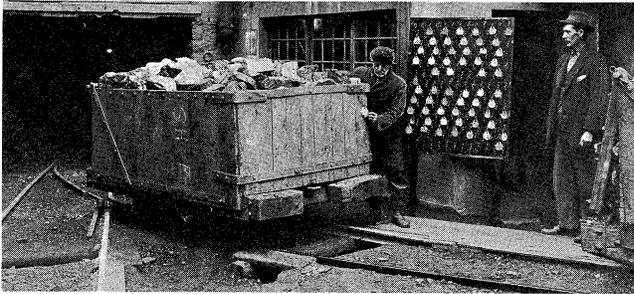
"Previous to the adoption of this [improved] method of ventilation [probably a furnace], they experienced great inconvenience from carbonic acid gas; and some of the workmen had been killed by an explosion of carburetted hydrogen gas."

Thus the beginning of coal mining in the U.S. duplicated the European experience. Men from the pits there migrated here to develop and work American coal mines for their livelihood, carrying with them their experience and their problems.

The early 18th century American experience of working the coal close to the surface and of having water and oxygen-deficient air as the chief hazards was similar to the experience in Great Britain in the late 16th century. The greater area and relative shallowness of coal seams here presented, and still present, a less acute problem in gassy mines compared with



Mules that hauled coal underground even came to be equipped with their own headlights.



Tagging each load at the mouth of the mine.

British mines. However, U.S. coal production increased at a much greater rate; the development of mines and the ensuing safety legislation covered a much shorter period.

The birthplace of the coal industry in America, as we know it today, rightfully belongs to the Appalachian coalfields. In 1786, 20 years after the city of Pittsburgh was laid out, William Penn was granted a charter to mine coal in the hills fronting the city. The Pittsburgh seam was mined for many years along the Monongahela River across from the city.

The first mining company, however, the Lehigh Coal Mine Company, organized in 1803, was an anthracite operation.

Richmond, Virginia suffered the first coal mine fatality, the first explosion and the first major disaster in a coal mine in this country. The disaster occurred in 1839 and caused the death of 40 miners. The next tragedy struck Pottsville, Pennsylvania, in 1847, with the loss of 7 lives. From 1850 to 1867, six mine explosion disasters killed 176, all in Virginia.

The Avondale disaster in the anthracite region was the result of a mine fire; the furnace ignited the shaft partition. It occurred September 6, 1869, and 179 men were suffocated. This was almost a duplicate of the Hartley Colliery disaster in England in 1862; both were instrumental in causing laws to be passed requiring two means of "egress." Recognition of the dangers inherent in coal mining first came at the Federal level in this country in 1865 when a bill was introduced in Congress to create a Federal Mines Bureau; however, the bill died before action was taken.

Records show an appeal in 1858 by the miners of Schuylkill County, Pennsylvania, to the State Legislature for a safety law because of the extremely high fatality rate. The appeal, however, was not considered. In 1866 a mine safety bill was introduced but was defeated in the State Senate. Three years later, however, a bill was passed. It provided for one inspector

for Schuylkill County. Other Pennsylvania counties were ignored. In 1810, the year following the Avondale disaster, a state safety law was enacted for the anthracite field. There was no effort then to provide safety legislation for the bituminous field.

A legislative effort in behalf of Pennsylvania soft coal miners was not made until 1876 when a commission was appointed by the legislature to study the industry. The first mining law for Pennsylvania's bituminous coal mines was enacted in April 1877 and provided for the regulation, ventilation and inspection of the bituminous coal mines of Pennsylvania. However, Pennsylvania was not the first state to enact a mine law for bituminous coal—Illinois was.

LAWS TO PROTECT

Many efforts by various states were made prior to 1870 but these proved ineffective. When the Illinois State Constitutional Convention of 1870 was organized, one of the first committees formed was one on "Mines and Mining." One of the first reports presented for consideration by the Convention was prepared by this committee. A full discussion of its merits took place in January 1870 and resulted in the incorporation into the constitution of the following language:

"It shall be the duty of the General Assembly to pass such laws as may be necessary for the protection of operative miners, by providing for ventilation, when the same may be required, and the construction of escapement shafts, or such other appliances as may secure safety in all coal mines, and to provide for the enforcement of said laws by such penalties and punishments as may be deemed proper."

Based on this finding, many legislative acts on coal mining were passed during 1870-80, including the one in Pennsylvania.

In Illinois, the first inspectors required by law were county mine inspectors and they were paid from county funds. This system did not succeed because the inspectors were paid inadequate wages.

A later revision required the appointment of a state mining board and five state mine inspectors. Other leading coal mining states had preceded Illinois in the adoption of such a system for selecting inspectors.

The county inspection system, however, was not completely abolished. The mining law authorizing state mine inspectors required county boards to employ county mine inspectors. Nearly all coal-producing counties employed county inspectors as assistants to the state mine inspectors.

In 1873, Ohio became the second state to recognize the need for safety laws in bituminous coal fields; Maryland was third in 1876; and Pennsylvania was fourth in 1877. Other states soon followed until all coal mining states had laws to prevent explosions.

As in the earliest years of coal mining in Europe, explosions in the United States increased for many decades. Since American mines are less gassy than most European coal mines, and because of experiences gained from European operations, one would expect that the rate of explosions here would have been less. However, U.S. coal mines were at first almost wholly owned by emigrants from European coal-producing countries. These emigrants brought with them their experience, their desire for greater independence and their bad habits. They left a strict, almost militaristic, supervisory system of mining, to work in a loosely regulated system in which the discipline known in the "old country" did not exist.

Some emigrants employed here as miners had never mined before. The emigrant youth became full-fledged mineworkers without the apprenticeship training in safety procedures regarded as essential in the old country. Tales at the fireside, at times exaggerated,

tended to impress the young miners that the discipline their fathers had lived under was "oppression." Need for individual care against explosions was apparently deemed of little importance by the old-timers and, therefore, was not stressed. Legislation seemed to be the answer for the prevention of explosions; but even as legislation was enacted improving ventilation and increasing inspections, there was an alarming increase in the number of explosions and the number of explosion fatalities at U.S. coal mines.

From 1880 to 1910, a large number of explosions from handling and using black powder added to the explosions originating from "firedamp." Bureau of Mines records indicate that between 1818 and 1910 there were over 7,000 fatalities attributable to explosions with countless other fatalities which were not recorded. Between 1906 and 1910, 2,388 fatalities from mine explosions were recorded by the Geological Survey.

RISING DEATH TOLL

On December 6, 1907, the greatest explosion in the history of U.S. coal mining shook the West Virginia



The mine entrance after the explosion of 1907 at the Monongah Mines.

countryside. About 10:30 a.m., twin explosions tore with tremendous force through two merged mines of the Fairmont Coal Company. The explosions could be heard eight miles away. According to newspaper accounts, buildings in Monongah tottered, pavements heaved, pedestrians and even horses were felled and streetcars were derailed as a pall of soot settled over the town. In a tragic flash, Mine No. 6 and Mine No. 8 located on the west bank of the river became a tortuous charnel house.



Waiting at the mine entrance for news after the explosion on December 6, 1907, at the Monongah Mines Nos. 6 and 8, Monongah, W. Va.

According to the official account of the incident, every man in the one-mile-square area of both mines—about 358 men—lost his life in the catastrophe. It is ironic to note that the exact count of men is not available, but all mules were accounted for. Legend has it, however, that there was one survivor, a miner named Pete Urban.

Thirteen days after Monongah, another explosion ripped through the Darr mine at Jacobs Creek, Pennsylvania, killing 239 miners.

In that year, 1907, a total of four disastrous mine explosions, including the Monongah and Darr explosions, killed a total of 690. The year 1907 also witnessed a record number of mine deaths: 3,197. The deaths were multiplying as production was increasing. Coal production had jumped 150 per cent from 1896 through 1907, and tons of coal produced per man-day had increased from 2.64 to 3.06.

The tremendous increase in production was accounted for in large measure by new mining methods. Electric haulage systems and mining machines came into use. With the introduction of new equipment and devices came new dangers, but precautions to

lessen the dangers did not keep pace. Mining conditions were quickly changing. Mines were deeper; more old abandoned workings were left to accumulate gas and dust; and more men were employed in individual mines than in former years. Consequently, in case of a gas or dust explosion, the likelihood of trapping more men was greater.

The times also witnessed an influx of foreign laborers, many of whom came from the agricultural regions of southeastern Europe. They had no expertise in mining, and their poor English prevented them from understanding on-the-job orders and instructions.

Although the coal mine inspection service had been increasing in efficiency from year to year, the various hazards were also increasing.

It was during this time that an awareness of the safety problem grew. In 1906-07, a survey was conducted by the Russell Sage Foundation. The results of this survey shocked the nation by stating that in one county (Allegheny County, Pennsylvania) 528 fatal industrial accidents occurred in one year. The results also stated that 5,000 workers were maimed and totally disabled while working at mills, mines, and railroads in that county.

In 1908, another significant explosion occurred at the Marianna mine, Marianna, Pennsylvania, taking 154 lives. At that time the mine belonged to the Pittsburgh-Buffalo Coal Company. The next year, 1909, the Cherry mine fire occurred in Illinois taking about 300 lives. The time was ripe for Federal legislation. As a result of these disasters the public became aroused. Congress reacted and the Federal government became involved in mine safety for the first time.

SAFETY MEASURES

The Organic Act creating the Bureau of Mines was passed in 1910. From 1910 to 1940, the Bureau's role was primarily one of advising, conducting experimental work and teaching various courses in accident prevention, first aid and mine rescue. Research work conducted included testing explosives that would burn for a short duration. This work resulted in the present day permissible explosives. Much experimentation was done on the use of rock dust to allay coal dust from propagating explosions. The first rock-dust applications were in the Victor America Fuel Company Mine in Colorado in 1912.

On December 7, 1938, an explosion occurred in Old Ben Mine No. 15 near West Frankfort, Illinois. Some areas of this mine were protected at panel

entrances and airways by a then new bag method, in addition to the rock dust which was regularly applied throughout the mine. The bag method was to erect rock-dust barriers composed of bagged rock dust by placing them on shelves near the roof. The normal night crew of 50 (400 worked the day shift) was working when an explosion occurred. The flame from the explosion was immediately extinguished upon contact with the dispersed cloud of rock dust from the bags. The person who ignited the gas was instantly killed. However, there were no other injuries, although adjacent workings were wrecked and concrete stoppings were demolished in the vicinity of the explosion's origin. The rock-dust bags at the panel entrance, some 250 feet from the origin of the explosion, were demolished along with the timber supports. The shock wave completely liberated and dispersed the rock dust. Rock dust was deposited in snow-like drifts 600 feet away from the rock-dust barrier. The experience gained from this incident set the pattern for our modern-day requirements for rock-dusting.

The first permanent cap lamp was tested and approved by the Bureau of Mines in 1915.

The Bureau was also involved in mine safety training. Accident prevention, first aid, and mine rescue were taught from railroad cars. A number of cars were located in strategic areas throughout the nation and were manned continuously by crews of eight or nine



It may not look like much by today's standards, but the advent of the airplane in the early 1900's did significantly advance the cause of mine safety. Rescue teams like this one in 1923 stood by to "rush" to mine disasters by air. By contrast today, giant C-130 aircraft can have rescue teams and tons of highly specialized rescue equipment at the scene of mine emergencies within a matter of mere hours.



Bureau of Mines rescue teams in 1917 were prepared to use Fleuss "Protox" apparatus, a self-contained breathing device that made use of compressed oxygen. Successor models are still being used throughout the world. Today's Mine Emergency Operations crews make use of the Drager BG-174A apparatus.



Bureau of Mines men prepare to lead first rescue team down Kinloch slope following the explosion on March 21, 1929.

men. Normally, they were used as a base for conducting training; however, they were equipped with mine rescue apparatus, gas detection equipment, and other equipment for use in emergency situations following mine fires and explosions. The Bureau's role in inspection and investigative work was very limited; often coal operators would not allow a Bureau employee on the property to conduct training or to conduct investigations following a mine accident.

In 1940, there were 18 explosions in the nation, accounting for 206 deaths. These explosions aroused the public. Congress reacted with passage of Public Law 49 in 1941, which gave Bureau inspectors the right to enter coal mines to make inspections and investigations. There was no set of rules or regulations mandated by Public Law 49, nor did it give inspectors enforcement powers. The inspections conducted under this law were of an advisory nature only.

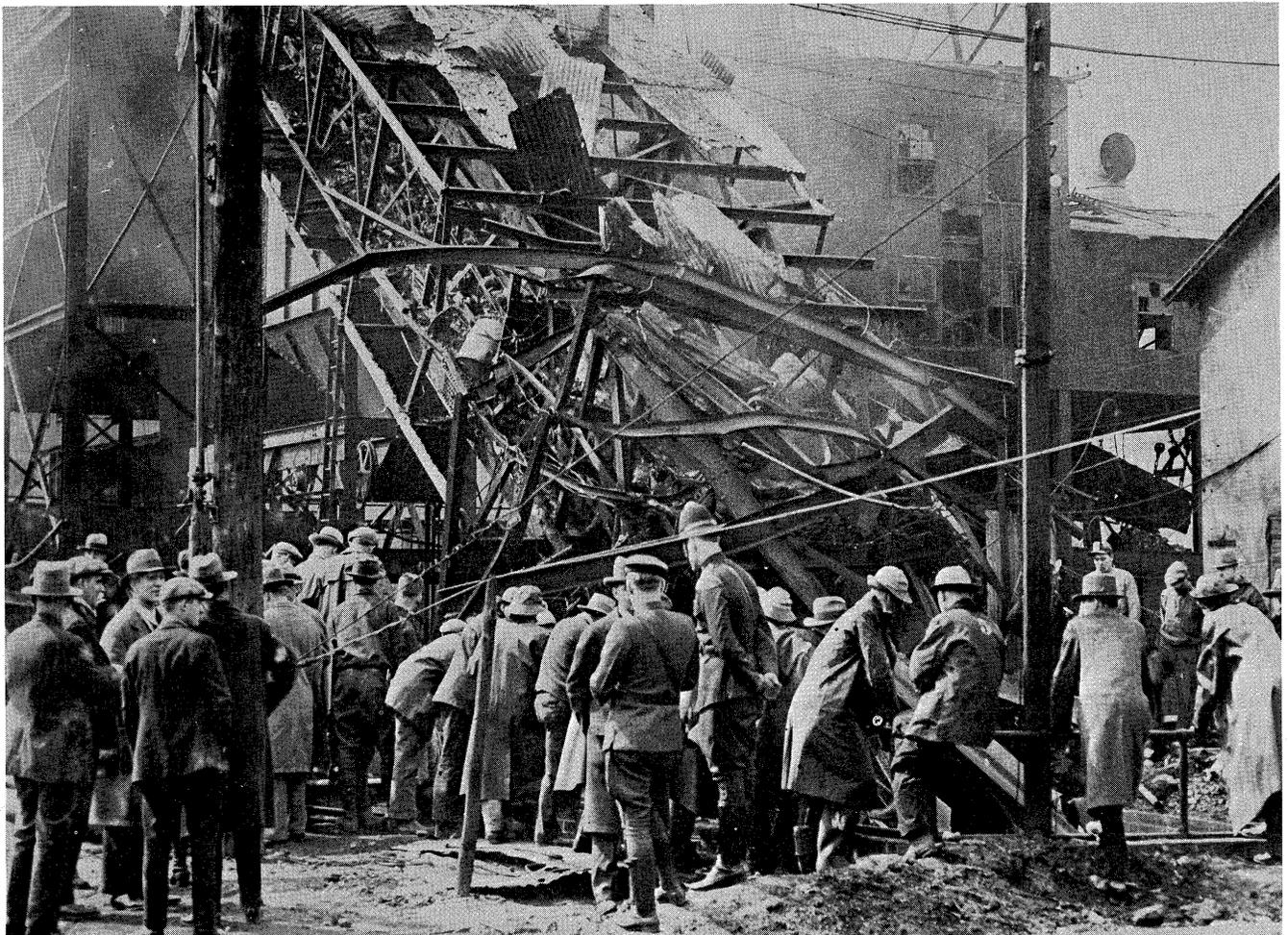
From 1941 through 1948, there were 37 major mine explosions that killed about 675 miners. A major explosion is defined as one that takes more than five lives at one time. There were another 213 minor explosions in these years, accounting for 157 lives lost. During these World War II years, an average of 1,300 miners were killed each year. There was also a tremendous push for coal production as part of the war effort.

Following World War II, in 1946, a strike occurred and resulted in the Federal government's seizing the mines and operating them for a short period of time. During the negotiations to settle the dispute, the first formal code of regulations for mine safety was formulated. Another important part of this settlement was the establishment of Safety Committees at union mines. The regulations were contained in the Federal Mine Safety Code of July 24, 1946, which served as a basis for inspections by Safety Committeemen and Federal Mine Inspectors. Again, these regulations

were advisory and not mandatory.

THE DECISIVE CALL

On March 25, 1947, another explosion of major proportions occurred at Centralia, Illinois, in which 111 men lost their lives. Nine days after this explosion the House of Representatives' Subcommittee on Miners' Welfare of the Committee on Education and Labor was convened. This committee met to hear testimony by John L. Lewis in the hope that Congress might take legislative action to prevent the recurrence of such terrible disasters as the one that happened at Centralia. It was during his testimony before this committee that John L. Lewis made one of his greatest efforts for mine safety. It was also during this testimony that he made his famous statement that "coal is already saturated with the blood of too many men and drenched with the tears of too many surviving widows and orphans." Even though Congress was sympathetic to his testimony, it took another



Wrecked trolley, conveyor and crowd at pit mouth following explosion at Kinloch Mine, Parnassus, Pa., March 21, 1929. The explosion killed 46 men.

series of explosions in 1951, culminating in the Frankfort, Illinois, Orient No. 2 mine explosion, before other action was taken. In this mine explosion, 119 men lost their lives.

Again, the previously apathetic public was aroused. Congress reacted to the public outcry for new legislation by passing the Federal Coal Mine Safety Act, Public Law 552, which became effective on July 16, 1952. This law used the preamble of the '41 Act as its Title I and created a new section, Title II. In Title II, 37 regulations were lifted from the 1946 code and became mandatory. Also, for the first time, federal inspectors could issue Notices of Violation and Orders of Withdrawal when imminent dangers were found. The imminent danger clause was first conceived by John L. Lewis during his testimony following the Centralia explosion in 1947. The '52 Act was designed specifically to prevent major mine disasters. A major disaster was defined as a mine explosion, mine fire, mine inundation, or a man trip or man-hoist-type accident which took the lives of 5 or more miners. The law excluded mines employing less than 15 miners underground. It also did not make provision for elimination of the day-to-day accidents that snuff out lives one at a time.

Following enactment of the 1952 Act some operators were quick to find loopholes and, rather than open one large mine, opened a series of small mines employing 14 miners each. This largely accounted for a sudden growth in small mine operations. Because of this growth, the accident records for small mines took a sudden and significant upturn.

In 1965, following two major mine explosions in small mine operations in Tennessee in which all nine employees in one mine and all five in the other were killed, Congress again reacted and passed the 1966 amendments to the 1952 Act. This law took away the small mine designation and thus governed all underground operations. It made it illegal to blast with black powder and included a provision for citing notices and issuing orders for unwarrantable failure of the operator to comply with provisions of the law, a concept that is also present in the 1969 Act.

Another significant part of this law was that it required the Bureau of Mines to conduct a study to update the 1952 Act, and in 1968 the final report of the special study was presented to Congress. In September of that year, legislation was introduced that included 22 recommended additions to the '52 Act. While the bill was in Committee, the Farmington disaster occurred.

Following the Farmington disaster no less than 42 separate bills were introduced in Congress. After many hearings and much debate, the Federal Coal Mine Health and Safety Act of 1969 was finally passed in December 1969. The President signed the law and it became effective December 30, 1969.

THE '69 ACT

The operative date was March 30, 1970, giving the Bureau 90 days to promulgate regulations. The regulations were promulgated and published in the Federal Register on March 28, 1970, a Friday. Inspectors met over the weekend to study the new regulations and on the following Monday the inspectors were in the field. To say the least, there was confusion under the new procedures. Some operators quickly capitalized on the problems of implementing the regulations and sought and secured an injunction against the regulations. During the summer of 1970, the basic law was enforced, but because of the lack of enforcement personnel, "PER" inspections were conducted in which a representative section of a mine, was selected and inspected. That inspection was considered to have satisfied the requirements of the Act. Meanwhile, an all-out effort was made to recruit inspection personnel to satisfy the requirements of the Act. The health and safety organization was expanded from approximately 250 people in 1969 to about 1,300 during the first two years the Act was in effect. On November 20, 1970, a new set of regulations was promulgated. These are, for the most part, the regulations in effect today.

Thus the history of coal mine safety legislation parallels the disaster experience of the coal mining industry. This article has focused primarily on the coal industry and the legislation governing it because of coal's long history of mine explosions and fires as well as its unacceptable accident rate. The accident and disaster record of the metal and nonmetal industry, although not as severe as that in coal mines, was recognized at the Federal level in 1961 when Congress passed Public Law 87-300. This law authorized and directed the Secretary of the Interior to study the causes of accidents and means to prevent injuries, health hazards, and other health and safety conditions in noncoal mines. The Secretary was to submit to Congress a report of his findings together with recommendations for legislation pertaining to health and safety in metal and nonmetal mines. As a result of the study and the findings of the Secretary, Public Law 89-577, The Federal Metal and Nonmetallic Mine Safety Act, was passed in 1966.

Hard-rock miners are reaping the positive effects of the Sunshine disaster—increased safety legislation



A bucket was used to hoist and lower men at the main shaft during rescue and recovery work following the explosion and fire at Mine No. 9, Jamison Coal and Coke Company, Farmington, W. Va. The disaster took 16 lives.

on their behalf. That disaster was responsible for many mandatory standards as well as increased inspections. There is today an effort to provide the same administrative provisions to metal and nonmetal mines as in the present Coal Act.

Our accident frequency and fatality rates have been greatly improved. There is much to learn from the past, for those who do not learn from the past are condemned to relive their mistakes. The public and the Federal government will no longer tolerate a deplorable accident record in the mining industry.

With the new demands on the industry, efforts to provide a safe and healthful working environment for the miner must be expanded. Only by an all-out effort on the part of all concerned—operators, miners, manufacturers, and state and federal regulatory agencies—can America move toward its ultimate goal—zero accidents.

—Robert Barrett
Administrator
Mining Enforcement
and Safety Administration